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NOTE TO EDITORS:

Enclosed is a summary of the findings of the Investigating Board appointed to examine and report on the May 10, 1967 landing accident involving the M2-F2 lifting body research vehicle at Edwards, Calif.

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(A copy of the M-2 accident report is available at NASA Headquarters, Room 6043, 400 Maryland Ave., SW., Washington; NASA Hq. Office of Advanced Research and Technology, Room 647, 600 Independence Ave., SW; and at the Public Affairs Office, NASA Flight Research Center, Edwards, Calif.)

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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M2-F2 Lifting Body Accident Summary

On May 10, 1967, the experimental M2-F2 lifting-body vehicle crashed in landing on Rogers Dry Lake at the NASA Flight Research Center, Edwards, California. The vehicle was piloted by Bruce A. Peterson, NASA research pilot and engineer. The M2-F2 was extensively damaged and Peterson sustained severe facial injuries.

An eight-man investigating board was appointed to determine factors leading to the accident, analyze the results, and make recommendations to minimize the possibility of similar occurrences in future flights.

The M2-F2 vehicle is one of the configurations used in a flight research program to investigate the problems and potentialities of piloted spacecraft that in the future may re-enter the atmosphere and be maneuvered to ground landings. The program to date has concentrated on subsonic glide and landings.

The May 10 flight was the 16th for the M2-F2. The research vehicle was released into unpowered flight from beneath the wing of the B-52 airplane at an altitude of about 45,000 feet. The flight path was a standard U-shaped

pattern with three legs and two left turns. Planned research maneuvers were conducted on the first two legs. The third leg was the landing approach. Prior to air drop, the pilot announced his intention to change the heading of the landing approach path to angle across the runway to reduce crosswind effects. This called for the pilot to make a slight S-turn (left, then right) on the approach leg, prior to landing, which is common practice.

The flight was normal through the second left turn into the approach leg. In coming out of this turn, leveling from a banked condition, a lateral oscillation (rolling from side to side) developed and quickly increased in amplitude.

Using established techniques, the pilot was able to correct the roll condition and regain control of the vehicle in 11 seconds.

By the time of recovery from the violent oscillation, the M2-F2's approach heading was to the left and angled away from the runway markings on the lake bed. The pilot found it necessary to immediately begin the landing flare without further heading changes.

The heading to which the pilot was committed left him without the runway-type markings normally used for

both landing direction and visual height cues and placed the vehicle on a flight path that caused him to be disturbed by the possibility of collision with the rescue helicopter hovering left of the runway markings.

Additionally, the violent roll motion had forced the chase plane pilots to swerve a safe distance away and placed them out of position to provide the normal altitude callouts via radio to the M2-F2 pilot.

The M2-F2 completed its landing flare and contacted the ground just as the descent (vertical) velocity was arrested and before the landing gear was extended. After bouncing, sliding and rolling over several times, the vehicle came to rest upside down. Landing occurred without the M2-F2 impacting the retreating helicopter which was several hundred feet away laterally.

The investigating board found that the immediate cause of the accident was an unusually low landing flare maneuver and premature ground contact. The board concluded that this was the result of an unusual set of circumstances that individually would not have ended in an accident. The major circumstances most pertinent as contributing factors were:

a. The pilot was overburdened in his normally exacting task by a combination of events that disoriented and distracted him and denied him normal height information.

b. The large amplitude roll oscillation during final approach that caused a temporary loss of lateral control of the research vehicle and changed the landing heading.

c. Potential collision with the rescue helicopter hovering near the path of the imposed landing heading.

d. Lack of visual height cues in landing area to which the pilot was committed.

e. Unavoidable absence of radioed altitude callouts from chase aircraft.

The major pertinent recommendations of the board include:

(1) Ways should be sought to ease pilot workloads in landing lifting-body-type vehicles. Consideration should be given to increasing the time allotted to the pilot for the landing phase and to improving the lateral-directional handling qualities to which the pilot is exposed during the landing phase.

(2) During landings of unconventional aircraft, the lake bed should be kept clear, not only in the

immediate, planned landing area but also in a much larger area in which an inadvertent landing might take place.

(3) Research flight planning, briefing, and monitoring procedures should be reviewed with the intent of improving the flow of information and insuring that all participants are kept adequately informed.

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